AGRICULTURE

Project Fact Sheet

FLEX-MICROTURBINE® FOR PECAN WASTE

INNOVATIVE PROCESS USES LOW-BTU GAS AND CATALYTIC COMBUSTION

Benefits

- Electricity generated using waste pecan nutshells will save 1.94 billion Btu per 30 kW installation
- Waste heat from the microturbine used to pasteurize and dry pecans will save 1.23 billion Btu of natural gas per installation
- Offers potential annual savings of 2.54 trillion Btu by 2010 from 800 installations

Applications

The initial benefit of the Flex-Microturbine will be realized by pecan farmers, with the potential to expand to other nut orchards and processing plants other nut orchards, wood waste and processing plants.

Project Partners

NICE^3 Program
Washington, DC

Arizona Department of Commerce, Energy Office
Phoenix, AZ

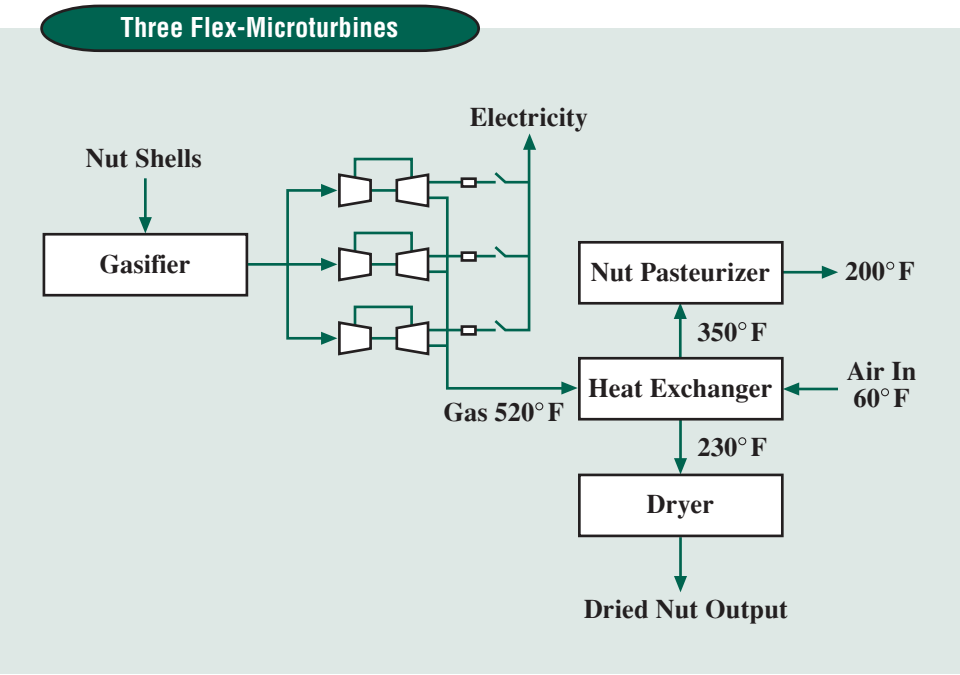
FlexEnergy
Mission Viejo, CA

Sierra Southwest Cooperative Services
Tucson, AZ

The National Rural Electric Cooperative Association/ Cooperative Research Network
Washington D.C.

Flex Energy, with assistance from the U.S. Department of Energy's NICE^3 program, the Arizona Department of Commerce, Sierra Southwest Cooperative Services, and the National Rural Electric Cooperative Association are demonstrating a novel microturbine system. It utilizes pecan shell waste to provide electricity and residual heat for nut processing operations. As tons of spent nut shells are gasified, the gas produced will be used to power the Flex-Microturbine and the residual heat used to pasteurize and dry the nuts at the facility.

Nutshells pose a major disposal problem. Every pound of nuts includes a half a pound of nutshells. More than 700,000 tons of nutshells are generated each year in the U.S., which is the energy equivalent of a half a million tons of coal. Nutshells do not posses nutritional value for livestock, nor are they suitable for composting. Gasification is possible, but the quality of the gas does not contain sufficient energy for traditional engines. The shells are mostly stockpiled or spread on the land, where they remain for decades.



Flex Energy's Flex-Microturbine is the first generation system able to effectively utilize gas from gasified nutshells, which is a low energy/low Btu fuel that was previously unusable.

The Flex-Microturbine is the first generation system able to run on low pressure/low Btu gas such as that derived from gasified nutshells. The low-Btu, low-pressure gas produces emissions well below 1 ppm, a small fraction of the emissions generated from internal combustion engines. The system also utilizes a catalytic combustion system that consumes potentially harmful emissions into heat that is used for nut processing. By utilizing the proposed technology, electricity can be generated, offsetting expensive purchased power, and natural gas costs can be reduced by 60%.

Project Description

Goal: Demonstrate the Flex-Microturbine, the first microturbine to generate heat and electricity with low-Btu, low-pressure gas derived from nutshells, thus eliminating the need for internal combustion engines in nut processing. When compared to existing methods, the new technology will clearly illustrate significant cost and waste savings for nut processing.

Traditionally, microturbines operate effectively with natural gas or other high-Btu gas, and require a minimal fuel gas pressure of about 60 Psig. Low-Btu gas would require compression to much higher pressure, making the process cumbersome, expensive and impractical. Typically, the low quality gas and air are compressed separately before burning. The Flex-Microturbine eliminates the need to separate the two and effectively mixes fuel and air before compression.

In this new system, the traditional combustor found in turbines is replaced with a catalytic combustor that burns the fuel-air mixture at much lower temperatures. The catalytic combustor running on a low Btu fuel-air mixture is related to the catalytic converter in automobile exhaust pipes that remove unburned hydrocarbons and carbon monoxide. Catalytic combustion keeps maximum temperatures of any portion of the system well below the temperature of NO_X formation. The clean exhaust gas is rich in oxygen, allowing it to be used for heating, or even as combustion air for downstream combustors.

Progress and Milestones

- Design system and purchase equipment – within first year following award.
- Install and test system – first 2 months following receipt of equipment.
- System operation and data collection – 2 to 3 years following award.
- Submit final report – 3 months following project completion.
- Outreach – ongoing.
- Report commercialization activities – annually for 10 years following completion.

Economics and Commercial Potential

This technology will provide a combined savings of over 3 billion Btu in electricity and natural gas use per 30 kW unit. First sales of the technology are expected by 2004. Individual nut processing sites are expected to use multiple units. Based on over 20% market penetration by 2010, annual savings would be 2.5 trillion Btu with 800 operating units. Market penetration of over 60% by 2020 will save over 5 trillion Btu from operations of 2,300 units.

NICE³ – National Industrial Competitiveness through Energy, Environment, and Economics:
An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry.
This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to $525,000. Grants fund up to 50% of total project cost for up to 3 years.

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